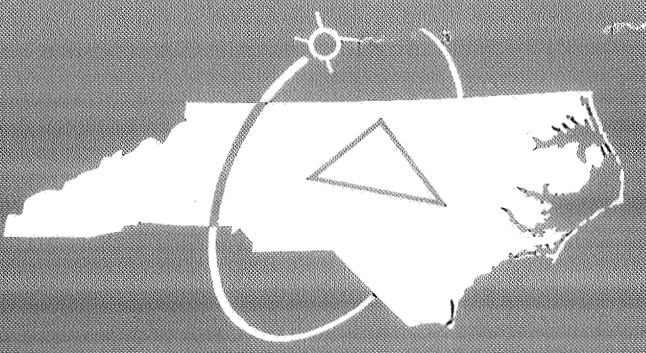


NORTH CAROLINA SCIENCE AND TECHNOLOGY RESEARCH CENTER

FOURTEENTH QUARTERLY PROGRESS REPORT

ON A

REGIONAL TECHNOLOGY TRANSFER PROGRAM

October 1, 1967 -- December 31, 1967

NORTH CAROLINA SCIENCE AND TECHNOLOGY RESEARCH CENTER

FOURTEENTH QUARTERLY PROGRESS REPORT

I. INTRODUCTION

This is the Fourteenth Quarterly Progress Report to be submitted to the Technology Utilization Division of the National Aeronautics and Space Administration and describes the operation of a regional dissemination center for new technology. The program was started in June, 1964, under contract NASr-235, and is currently supported by NASA under contract NSR 34-007-003. Program support is also provided by the North Carolina Board of Science and Technology and by subscription fees from participating companies.

Objectives of the experimental program are "the enhancement and acceleration of the process of transferring new technology derived through Government sponsorship to uses additionally benefitting the private and public sectors of society."

Work relating to activities under contract NSR 34-007-005 is covered in a separate progress report.

II. STAFF

On December 31, 1967, the staff of the North Carolina Science and Technology Research Center (STRC) consisted of the director, the assistant director for operations, the assistant director for marketing, a technology utilization manager, three applications engineers, an information specialist, a computer programmer, a technical editor, an assistant librarian, an accountant, six clerical assistants, and two secretaries.

III. ACTIVITIES

A. STRC Operations

On December 31, 1967, STRC was furnishing regular services to 39 organizations, for a current subscription level of $19,700. The subscription aggregate totalled $36,350. Of the current clients, 31 are paying subscription fees for annual services, and eight are on a fee-per-service basis.

Companies receiving services under yearly subscriptions totalling $18,150 are listed below.

Aeroglide

Aerotron, Inc.

Allvac Metals Co.

American Enka

Athey Products

Beaunit Fibers

Burlington Industries, Inc.

Celanese Fibers Co.

Columbia Products

Corning Glass Works

Cornell-Dubilier Electric Corp.

Electro Motive Manufacturing Co.

Engineering for Industry

Exide Missile & Electronics Division

General Electric

Genesco, Inc.

Gilbert & Barker Manufacturing

Hercules, Inc.

Hilemn Laboratories, Inc.

International Business Machines

Northrop Carolina, Inc.

Pheumafil Corp.

Philip Morris, Inc.

Reynolds Metals

A. H. Robins Company, Inc.

Research Triangle Institute Biomedical Applications Team

Standard Crankshaft

Taylor Instrument Co.

Technitrol, Inc.

Thomasville Furniture

Troxler Electronics Laboratories, Inc.

Participating on a fee-per-service basis were the following organizations:

Allied Chemicals

Clemson University

Chemstrand Research Center

Gillette Safety Razor

North Carolina State University

Research Triangle Institute

Stencel Aero Engineering

University of North Carolina

1. Computer Retrieval System

The program for searching an inverted file mounted on direct access storage devices (DASD) is being checked out. This program

uses Fortran IV as the basic coding language and operates with IBM's OS/360, Release 11. Data flow is handled by assembler-language subroutines in combination with IBM's Indexed Sequential Access Method (ISAM).

We are replacing our inverted search file with an up-to-date file on IBM 2314 DASD. The new file is being loaded using blocking factors and other parameters from an analysis of the previous file.

We are comparing the costs of citation retrieval from a tape-mounted citation file, a file on DASD, and a manual (abstract card) system. We expect to utilize the tape-mounted file as an intermediate step in creating the direct-access file.

2. Information Resources

The Office of State Technical Services, U. S. Department of Commerce, was unable to fund the proposal submitted by Chemical Abstracts Service for an experimental program to make chemical literature available to STRC clients.

A proposal is being prepared by North Carolina State University for continuing and expanding the experimental file on textile fibers constructed by Professor Stanley Backer of Massachusetts Institute of Technology. STRC will participate in this program by undertaking the redesign of the computer search system for compatibility with third-generation computers, and by participation in user testing.

3. Marketing Program

In the last Quarterly Report, it was noted that most of the industries in North Carolina having the need and potential capability to use the Center's services had been contacted, and the same can now

be reported concerning South Carolina and Virginia. During the quarter STRC personnel made several trips to both states to contact prospective clients. A total of 35 companies in North Carolina and other states were approached during the quarter.

As discussed under III B, Meetings, Trips and Visits, top level administrative personnel and faculty members at three leading universities were apprised of the Center's services. A special effort has been made to stimulate interest at institutions of higher learning, particularly with those schools and departments and faculty personnel heavily committed to research.

Certain agencies of North Carolina and South Carolina State Governments also were approached during the quarter and encouraged to use the STRC information plan.

Marketing efforts have been expanded by a stepped-up mailing program. Letters describing the Center's services and soliciting appointments have been mailed to companies identified as having a research and development capability.

Staff personnel have noticed in recent months a growing number of instances in which unsolicited companies have contacted the Center asking for information on the NASA system. The fact that they have heard about the STRC from third parties indicates that the Center's reputation is favorable and becoming more widespread.

At the close of the last report period, October 31, the Center had a total of 36 clients on annual subscriptions and nine on a fee-per-service basis. During the current report period, ending December 31, five new clients were added, six resubscribed, and eleven were dropped, for a total of 39 clients--31 on yearly subscription and eight in the fee-per-service category.

The total of current annual subscriptions as of December 31, was $14,700, with a cumulative total of $36,350 for all services provided by the Center to date.

4. Impact of Technology Utilization Operation at STRC on Education at Research Triangle Universities

This section discusses the ways in which the program of the North Carolina Science and Technology Research Center has affected education at the three Research Triangle Universities--North Carolina State University at Raleigh, the University of North Carolina at Chapel Hill and Duke University at Durham. Two specific examples are cited along with some general comments.

In the first example, Dr. Edward W. Erickson, a young, promising member of the economics faculty at North Carolina State University, was retained to conduct the NASA-sponsored study measuring the benefits to industry from the Center's operation. Prior to his employment, he was only slightly aware of the STRC's activities and the extent to which NASA is involved in attempting to speed industrial development via the technology utilization program. Now, as a result of that study, he has a good appreciation of the goals and problems of the T. U. program, and this knowledge cannot fail to be reflected in his teaching and private research.

Another instance involves Professor R. B. Knight, L. L. Vaughn Professor of Mechanical Engineering at N. C. State, who is a recognized authority in the field of heating and air conditioning, and who has contributed to nuclear power plant heat exchanger design. It is the usual nature of activity in his field to change method and equipment gradually, and for this reason his interest in space-related

activity had been of only a passing nature. Recently, however, he was asked to present a lecture at the University of Puerto Rico on spin-off from the space age. He was directed to STRC for information and came away well prepared with material for his lecture, with a new appreciation of the operation of the T. U. program, and a keener insight as to how seemingly unrelated developments of space research can have an impact on the commercial market. Consequently, it is likely that students in his courses as well as his consulting clients will be directed to the Center when special information is required.

Thirdly, the Center's program--funded by NASA--to provide low-cost computer searches to graduate students for their thesis research has been instrumental in showing students in fields other than aerospace and electrical engineering that:

1. The space program has generated much new technology having application to a variety of fields, and
2. The computer search system developed by NASA has considerable potential for increasing the effectiveness of literature searches and reducing the time required to make them.

It is in their student years that individuals are most amenable to new ideas. As the impact of this program spreads--that is, having more students appreciate the ease and increased scope of search made possible by a computerized search system--the quality of graduate student research, particularly in the smaller, less well-supported universities, should improve materially. It is obvious, too, that if the graduate students do a better job on their research, their faculty advisers also benefit. This improvement eventually will make itself felt as better-prepared undergraduate course instruction.

Finally, some general observations may be made. The engineering and science faculties at most universities constitute somewhere on the order of 25 percent of the total faculty. Even among this fraction, only a small portion is aware of the range of the NASA T. U. program by virtue of their involvement in sponsored research. These individuals use STRC services from time to time as well as receiving service directly from STIF. Additional interest has been generated on university campuses by the NASA fellowship program. But it remains a fact that to a very large majority of the faculty of most institutions of higher learning in this country, NASA is synonomous with an unnecessary diversion of public resources from pressing social problems. They are simply unaware of the impact that the competitive organization of human and industrial resources toward the accomplishment of a specific goal on a tight schedule can have on industrial technology and scientific development in all areas related to the goal field. The spin-off, while difficult to trace directly, is there nevertheless. Computer developments linked with information retrieval--a conjunction NASA has found necessary to advance its research and development goals efficiently--will sooner or later reach all aspects of university scholarly research. If the name of NASA is identified with this at the outset, a very substantial reservoir of goodwill will be created at most universities. Further, as more university faculty come to realize how identifying a realistic set of goals and employing efficient systems management can lead to successful accomplishment of the task, faculty working in the social sciences, politics, and public administration will begin to see the need for more effective research in and management of social resource development programs. This diffusion of the idea of setting critical standards and dropping programs and personnel that do not achieve them--an idea which

has long been accepted in space programs--into the social science fields could lead to improved programs and awareness of NASA as the model for such improvement. These results, of course, will not be immediate and NASA must operate its program of information dissemination within all branches and fields of the university on a continuing basis to bring the effort to fruition.

B. Meetings, Trips and Visits

Six STRC staff members made trips throughout the eastern United States to attend conferences and other meetings.

During the week of October 2-6, the 50th Anniversary activities at NASA's Langley Research Center were attended by P. J. Chenery, director; Dr. Fred Smetana, assistant director for operations; and Col. Lem M. Kelly, assistant director for marketing.

Approximately 150 of the leading business and industrial leaders from throughout the State of Alabama viewed the STRC slide presentation describing the NASA information system at the annual meeting of the Associated Industries of Alabama, on October 12. The history and current status of the system were described by Mr. Chenery, who was accompanied by Col. Kelly. Extensive newspaper and other mass media coverage was given Mr. Chenery's speech. The Center's invitation resulted from a letter sent to State Technical Services authorities in Alabama describing the Center's services.

J. Graves Vann, Jr., technology utilization manager, attended the National Metal Congress, sponsored by the American Society for Metals in Cleveland, Ohio, on October 16-19.

Vann and Applications Engineers G. M. Wylie and Arthur W. Lockwood, Jr.

attended the Minerals Research Laboratory Workshop on November 3 at North Carolina State University at Raleigh. Four computer searches bearing on topics under discussion were run and were used by one of the speakers in his talk. They were later made available for review by the approximately 30 attendees to illustrate the usefulness of the NASA system. The three staff members also distributed brochures describing the Center's services. Titles of the four computer searches, which produced 517 hits, were Pigments, Alkali Metal Silicates, Beneficiation of Minerals, and Coatings.

Kelly and Vann gave the slide presentation November 8 at Princeton University to the librarian, director of research, and associate dean of the School of Engineering and two of his assistants.

On November 9, in Raleigh, Kelly and Wylie attended the Governor's Conference on Economic Development.

The Symposium on Methods of Materials Selection, held November 14-16 at Florida State University, was attended by Vann.

The slide presentation was viewed by administrative officials and faculty members at the Universities of South Carolina and Tennessee on November 28 and December 19 respectively. Among those seeing the presentation were the directors or deans of research and the Graduate School at both institutions, the dean of the School of Engineering at the University of Tennessee and the assistant dean of engineering at the University of South Carolina. Kelly and Vann gave both presentations to a total of about 35 educators.

Mr. Chenery additionally extended his duties to the following endeavors in these cities:

October 24-25, presented a paper to about 30 persons at the Institute on the Transfer of Technical Information, held at American University in Washington, D. C. He discussed experiences gained in the Center's operations.

October 31-November 1, spoke on STRC's operations and search system at a meeting of NASA's three Biomedical Applications Teams, held at the Center and the Research Triangle Institute.

November 9, visited Avco Space Systems Division in Lowell, Mass., to obtain followup information for the report on the Symposium on Advanced Technology Available for Commercialization, co-sponsored by the Center.

November 21, visited National Academy of Science in Washington, D. C., to discuss other computer-indexed information systems.

December 1-2, attended a meeting of regional dissemination center directors in Chicago.

December 12, spoke to more than 100 business students at St. Augustine's College in Raleigh, North Carolina, about the STRC program.

December 28, Mr. Chenery, accompanied by several other staff members, gave the slide presentation to about 25 engineers and supervisors of the Rockwell Manufacturing Company, a prospective client in Raleigh.

C. Statistics

This section lists the number of documents disseminated by STRC during the report period. Categories of usefulness have been established by STRC engineers, based on information from client companies and on the engineers' judgement in light of the companies' interests and capabilities.

Figures in this section represent complete documents.

1. Search mailings

a. Categories	Number sent
Pertinent -	634
(This classification is established for documents containing technology having a direct bearing on processes, products and equipment actually being used by the industries to which they are sent. Described are processes, etc., that may be readily adapted with a minimum of additional research and reorganization.)	
Interest -	46
(Documents representing advancement in a given area of operation and relating to products, etc., that fit naturally and logically. Technology may be employed after additional in-house developmental research.)	
Background -	0
(Documents which review state-of-the-art in a general area of interest which might serve to expand the receiving organization. Documents that contain theoretical and developmental research reports. Sent usually only to large companies with greater ability to understand and adapt new technology.)	
Total sent	680

b. Total STAR Documents (categorized) - - - - - - - - - 383
Total STAR Documents (uncategorized) - - - - - - - - 0

c. Total IAA Documents - - - - - - - - - - - - - - - - - 253

d. Total Documents from other sources - - - - - - - - - 47

(Open literature, in-house generated bibliographies not categorized.)

2. Industrial applications mailing

a. Number of research reports - - - - - - - - - - - - - 636

b. Number of reprints of open literature plus documents prepared in-house - - - - - - - - - - - - 333

c. Number of Tech Briefs and Flash Sheets - - - - - - - 22

d. Number of companies sent to - - - - - - - - - - - - 60

3. Number of retrospective search requests received from companies - - - - - - - - - - - - - - - - 30

4. Total number of scientific and technical personnel receiving regular service from STRC - - - 1500

Classification of Documents Sent in Search Mailings

1962 STAR

Category	Number Sent
11	1
14	3
16	4
18	1
32	1
Total	10

1963-64 STAR

Category	Number Sent
01	3
02	2

06	2
07	2
08	1
09	8
10	4
14	2
15	4
16	14
17	13
18	2
19	2
20	1
23	2
26	3
27	1
33	2
Total	68

1965-67 STAR

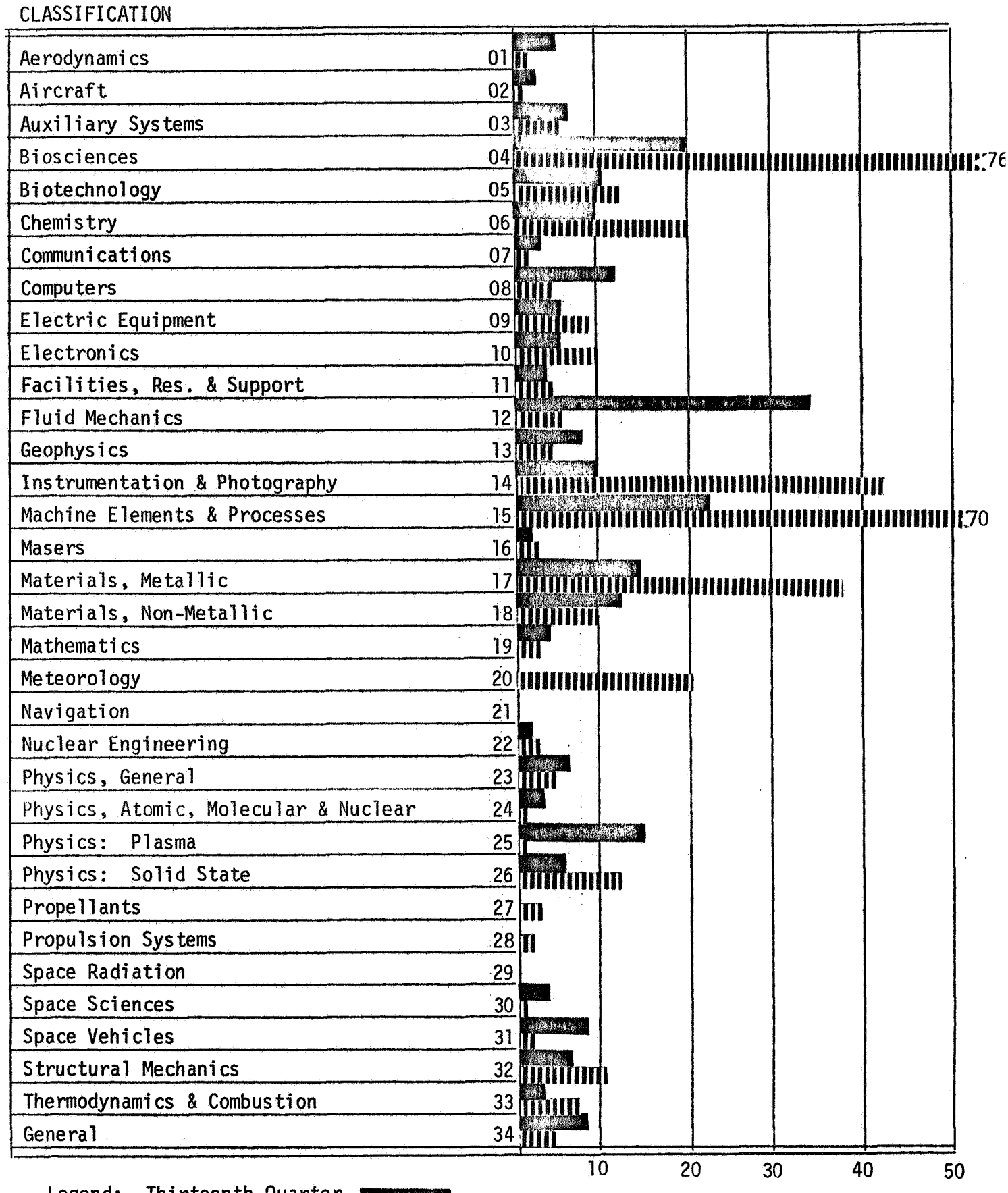
Category	Number Sent
02	1
03	4
04	58
05	11
06	18
07	1
08	5
09	9
10	2
11	1
12	5
13	5
14	39
15	54
16	3
17	35

18	8
19	2
20	1
22	3
23	3
24	1
25	1
26	13
28	1
30	1
31	2
32	8
33	8
34	2
Total	305

The graph on the following page illustrates the total number of documents, with 1967 Classifications, transferred by STRC in the Thirteenth and Fourteenth Quarters.

TOTAL DOCUMENTS TRANSFERRED FOR

THIRTEENTH AND FOURTEENTH QUARTERS



D. Computer Searches

A total of 30 retrospective searches and 200 computer updates in the quarter produced 13,002 citations. These resulted in 2,106 evaluated abstracts which were mailed to client companies. Fifty-two additional searches were run under a special project. The retrospective searches were as follows:

Cryogenic Methane
Documents Authored by Dr. F. O. Smetana
The Mechanism of Diapedesis
Manufacture of High Resolution CRT Screens
High Accuracy Miniature Timing Equipment
Analysis and Measurement by X-Ray Techniques
Automobile Testing
Pyrotechnic Flares
Pigments
Alkali Metal Silicates
Beneficiation of Minerals
Assay of Microorganisms in the Upper Respiratory Tract
Automobile Testing Including Wheel Testing
Truss Frames
Metal Stamping-Emphasis on Steel and Stainless Steel
Dry Film Lubricants on Metal-Techniques of Application
Hardness Testing
Accelerated Life Testing
Effects of Radiation (Microwave through Ultraviolet) on Biological Systems
Microwave Delay Lines and Phase Shifters
Chemical Reaction of Aluminum and Hydrocarbon Lubricants
Heating and Curing Dielectrics
Measurement of Oxygen & Carbon Dioxide in Blood & in Expired Air
Cholesterol & Lipid Metabolism
Motion Sickness
Optical Radar & Light Scattering
Pumping & Metering Cryogenic Fluid
Curing of Adhesives, Coatings and Paints

Intermetallic Compounds and Alloys

Study of Fermi Surfaces of Aluminum and its Alloys Using Ultrasonics

IV. PLANS FOR NEXT QUARTER

A. Marketing

As discussed under III A 3, Marketing Program, most potential subscribers in North Carolina, South Carolina and Virginia are now aware of the Center's services. However, new and expanding industries in the three states will be approached as events warrant, and marketing personnel wll ascertain if any other companies can profitably use the NASA information system.

STRC will continue to expand marketing efforts to Southeastern states other than the three already discussed.

Generally, during the coming quarter, the marketing program will give first priority to industries, research organizations and institutions of higher learning having a need and capability to use scientific and technical information. Efforts also will be made to influence certain state agencies to use the services of STRC. The mailing program will be increased, to approach an ever-growing number of companies.

B. Computer Retrieval System

Following the checkout of search programs and the new inverted search file, we expect to transfer the majority of our search activity from the 1410 Mod II Linear Search System to a local S/360 computer.

Work on a computer retrieval system for document citations will be continued. Programs to create a tape-mounted citation file, and to load this file on direct access storage devices, will be written

and checked out.

Cost studies of the new search system will be made to provide data to support our subscription charges to clients.

C. Information Resources

STRC will continue to monitor the development of computer retrieval systems for chemical literature by Chemical Abstracts Service and others. We hope to undertake an experimental dissemination program as soon as data collections and search programs can be obtained.

Liaison with the School of Textiles at North Carolina State University will continue in an effort to establish a computerized textile information program there.

APPENDIX A - CASES OF TECHNOLOGY TRANSFER

New developments are reported in Cases 58 and 106, which were first discussed in earlier quarterly reports.

CASE NO. 58

As previously discussed in the Seventh and Thirteenth Quarterly Reports, a client whose identification number is 0124 is attempting to design a battery capable of withstanding shocks of 5,000Gs sustained in landing instrument packages on the planet Mars. The intended use is for the Voyager program.

The firm's engineers had discovered that titanium subjected to heat sterilization temperatures in the presence of concentrated potassium hydroxide severely corrodes and liberates hydrogen gas. The released hydrogen gas builds up sufficient pressure to break the seal which contains the electrolyte in the cell case.

A search of the NASA system did not produce enlightening information on any materials which were not subject to corrosion in such an atmosphere.

Applications Engineer Gayle M. Wylie then made arrangements for Mr. Jerry Waller, instructor in metallurgical engineering at North Carolina State University, to consult with the client. As a result of conversations with Mr. Waller, the client sent an engineer to Texaco Experiments in Richmond, Virginia, to explore the use of boron filaments in a silver matrix to form a grid and replace the titanium.

It appears at this time that the high cost of the boron filaments and the amount of development necessary to incorporate this innovation will preclude the use of this approach in work under the present contract. However, the client hopes to be able to exploit this approach

as the price of boron filaments decreases.

CASE NO. 106

Mr. Waller continued to assist a second client, whose identification number is 0354. As first discussed in the last quarterly report, a manufacturing firm reported a problem of corrosion of the surface of roller burnished cylindrical tubes after a rather short time in service. The tubes are used as pistons in hydraulic car lifts.

Mr. Waller visited the company with Applications Engineer G. M. Wylie and obtained samples taken from the hydraulic lift plungers at various stages of manufacture. Magnification of cross sections of the samples indicated stresses produced in the turning and burnishing operations created a condition which made the parts highly susceptible to corrosive attack.

Elimination of the problem can following numerous paths, Mr. Waller reported to the company. The obviously desirable features of roller-burnishing make it undersirable to eliminate this method of final finishing of the plunger surface, but the burnishing operation is probably the major single contributor to the accelerated corrosion. Roller burnishing appears to be unique with the client, and the problem seems to be confined to this company. Less desirable grinding or plating processes would add significantly to the production costs but conceivably the corrosion problem would be minimized.

A number of surface finishing possibilities could be considered, he wrote, including: shot peening, blueing, oxidizing, carburizing,

or plating of various types. Possibly the roller burnishing operation can be used for finishing the plungers, but a subsequent treatment will be necessary to control the corrosion problem. He concluded that a project to evaluate pre- or post-burnishing treatments would reveal the best approach to a solution.

After receiving his report, the client indicated an intention of arranging for additional consulting services with Mr. Waller.

In response to a request by the company to supply the resume of someone to consult in the area of gear design, Mr. Wylie suggested John K. Whitfield, associate professor of mechanical engineering at North Carolina State University.

APPENDIX B - REFERRAL AND CONSULTING ACTIVITIES

CASE NO. 22

The assistant director of engineering at a client firm, whose identification number is 0124, requested assistance in locating equipment to perform X-Ray radiography. As a quality control procedure, the company has for some time been using X-Ray radiography to examine the activators for their automatically activated batteries. In recent months, the firm has begun using the same technique to examine the internal condition of completed batteries and cells.

To date, this work had been carried out on equipment at North Carolina State University at Raleigh; however, this arrangement has proved unsatisfactory for two reasons. The University has no personnel regularly assigned to operate the equipment and is not really in, or interested in getting involved in, this type of activity. Secondly, the equipment available at NCSU is of marginal power for the present work and will not be large enough for anticipated needs.

It appears that a 50 to 250 kv machine will be needed for future work. Applications Engineer Gayle M. Wylie contacted the IBM Corporation and learned that company has 150 and 350 kv machines, and that it would be willing to assist the client with this work on a temporary basis. However, IBM is not in a position to arrange contracts which would handle all the future requirements of the client.

Rockwell Manufacturing Company has radioactive sources which are strong enough to do the required work; however, the radioactive source seems to be inferior to X-Ray for the desired application. The Pittsburgh Testing Laboratory in Durham was then contacted and the situation explained to it. This company, which does commercial testing, has

available in a trailer a radio isotope source strong enough for the desired need, and will place the trailer at the client's location when work is to be done.

Exploratory work using this equipment indicates, however, that it is not as well suited to the client's purposes as an X-Ray machine. The client is presently negotiating with the Pittsburgh Testing Lab to determine if this laboratory could justify investing in the required X-Ray equipment.

The laboratories contacted by the Center are the only ones in this geographical area capable of performing the specified task. If the proposition with Pittsburgh does not materialize, it appears that the client will have to invest in the capital equipment necessary to perform the operation.